International Journal of Agricultural Science and Research (IJASR)
ISSN(P): 2250-0057; ISSN(E): 2321-0087
Vol. 4, Issue 1, Feb 2014, 107-112

THE EFFECT OF RANGELAND PROTECTION ON THE NATIVE VEGETATION PRODUCTIVITY AT SHOUBAK IN JORDAN

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ABSTRACT

The rangeland of Jordan was deteriorating due to severe drought and man misuse. The present study was conducted at Shoubak on 2012. The main objectives of this study are to study the effect of rangeland protection on native vegetation productivity, stocking rate and prepare of plant list prevailing in the study area. Fresh yield, dry yield, allowable yield of the native vegetation productivity and stocking rate was estimated using CRD and a plant list was prepared. The results showed sandy clay loam texture and alkaline soil, good available P, low available K, low N content and good O.M content. High significant difference between the protected locations and the non-protected ones in fresh yield, dry yield, allowable yield and stocking rate were noticed. The protected locations showed 568 % increase in fresh yield, 727 % in dry and allowable yield and 731 % in stocking rate. The total number of plant species was 24, belongs to 14 plant family were found in the reserve. Based on the present study, rangeland protection is highly recommended to increase their productivity, stocking rate, control rangeland deterioration and desertification.

KEYWORDS: Native Vegetation, Rangeland, Protection, Jordan

INTRODUCTION

The rangeland of Jordan forms about 90% of the total land area which is 89777 km^2 and called Badia region (MOA, 2005). It is receiving annual rainfall less than 200 mm. It was deteriorating due to successive drought and man misuse during the past 50 years. The man misuse such as early and over grazing, plowing for barley cultivation and fodder shrubs cutting are the main factors that leading to rangeland degradation and desertification (Al-Satari *et al.*, 2012).

However, rangelands protecting is considered as a national task. Rangeland protection, fodder shrubs and water harvesting of the rangeland are considering the main solutions for restoration and improving rangeland region and increasing their plant biodiversity. Ministry of Agriculture (MOA) was established about 30 rangeland reserves of about 80000 hectare (MOA, 2009) which, increased forage productivity about 5 times in comparison with unprotected rangeland (MOA, 2005). Al-Satari *et al.* (2012) showed the same results, improving stocking rate with the same percent and recommended rangeland areas in Northern Badia of Jordan protection in order to decrease the forage export and improve livestock owner socio-economic status.

A range reserve was established at Aljahair region in Shoubak city on 2012. The main objectives of the present study are to study the effect of rangeland protection on native vegetation productivity, stocking rate and prepare of plant list prevailing in the study area.

METHODOLOGY

Site Description

The study was conducted in Aljahair region at Shoubak city in the Southern Badia region in Jordan. Shoubak located 220-km at the southern of Amman at Ma'an Governorate (1535 m above sea level). The average annual rainfall is 180 mm. The area of this reserve is approximately 3 ha.Two sites were selected to study their productivity; one protected using metal fence and the second neighbouring to the first unprotected location and subjected to overgrazing. The protected location was fenced, while non-protected representing an open access location for livestock grazing. Data of the native vegetation was collected during May 2013.

Soil Analysis

Two soil samples of 2 depths 0 - 30 and 30 - 60 cm were taken for the protected site. The following analysis had been done:

- The soil Electrical Conductivity or soluble salts (EC) using the EC – meter. It was determined by measuring the electrical conductivity on 1:1 soil to water extract (Rhoades, 1982).
- Soil pH (acidity or alkalinity) using pH – meter. It was measured on 1:1 soil: water suspensions with glass electrode using a pH meter (McLean, 1982).
- Texture (Soil Type) using Hydrometer method following dispersion with sodium hexameta phosphate (Gee and Bauder, 1986).
- The total Nitrogen (N) using Kjeldahl method (Bremner and Mulvaney, 1982).
- The available Phosphor (P) using Olsen method using Spectrophotometer (Olsen *et al.* 1954).
- The Exchangeable Potassium (K) was extracted using 1M NH_4Cl and 0.5 M $CaCl_2$ using flame photometer and Calcium Carbonate ($CaCO_3$) was determined using Cilicia meter. It was measured through calcium carbonate equivalent values by acid neutralization method (Richards, 1954), and
- Organic Matter (O.M) using Walkley – Black method (Nelson and Sommers, 1982).

Native Vegetation Productivity: It was estimated by using clipping method which was the most common method to estimate native vegetation biomass production (Bonham, 1989). Thirty samples were taken randomly in each treatment of this experiment on May 2012. Sex transects and 5 quadrates / transect of 1 m^2 were practiced. The native vegetation plants was clipped, weighted for fresh weight, dried in an oven at 72 ^{0}C for 72 hours and weighted again for dry weight. Then productivity kg/ha, allowable productivity and stocking rate were calculated. The yield components were defined as follow: Fresh yield: the total amount of the clipping forage in the sample in gram per 1 m^2 then converted to kg/ha. Dry yield: the total amount of the clipping forage in the sample after drying in gram per 1 m^2 then converted to (kg/ha). Allowable yield: the total amount of the clipping forage in the sample after drying that allowed for sheep grazing (kg/ha). It was estimated by 50 % of the total dry yield (kg/ha). Stocking rate (head/hectare/90 day): animal numbers and grazing period were calculated.

Plant List

The prevailing plants in the study area in Aljahair region at Shoubak were collected, classified and a list was prepared including family and scientific name.

Experimental Design and Statistical Analysis

The experiment was conducted using Complete Randomized Design (CRD). Sex replications were used (Each transect was considered one replication). A general linear model (GLM) procedure (SAS, 2001) was used for analyzing the data. The independent variables included in the model were protection, while, the dependent variables were the fresh and dry yield, allowable productivity and stocking rate.

RESULTS AND DISCUSSIONS

Soil Analysis

The results of the soil analysis showed sandy clay loam texture. "Table 1" shows high pH and EC which reflected alkaline soil due to the presence of calcium carbonate which classified as strongly alkaline soil. At high pH values availability of most micronutrients except boron (B) and Molybdenum (Mo) tends to decrease. Soil analysis showed good available P, low available K and low N content. Also, the O.M content is good in comparison with the semi-arid sites soils that having normally less than 1 % (Ryan *et al*, 1996).

Productivity and stocking rate: There is high significant difference between the protected locations and the non-protected ones in fresh yield (P=0.0006), dry yield, allowable yield and stocking rate (P=0.0001). The protected locations showed 568 % increase in fresh yield, 727 % in dry and allowable yield and 731 % in stocking rate "Table 2". Site protection and prevent grazing were resulted in suitable plant growth, reaching the final growth stages and showed the last outcome more productivity and stocking rate improvement.

Table 1: Average pH, EC (dS/m), P (ppm), K (ppm), N (%), O.M (%) and $CaCO_3$ (%) of Two Depth at Aljahair Reserve Site

Depth (cm)	pH	EC	P	K	N	O.M	$CaCO_3$
0 - 30	8.2	0.87	24.35	56.95	0.094	1.825	45.15
30 - 60	8.2	1.375	19.9	43	0.084	1.375	51.35

Table 2: Fresh Yield, Dry Yield, Allowable Yield and Stocking Rate of Protected and Non-Protected Sites at Shoubak

Treatment	Protection ± SE	No-Protection ± SE
Fresh Yield (kg/ha)	786.1 a ± 101.02	138.4 b ± 142.87
Dry Yield (kg/ha)	481.81 a ± 56.96	66.29 b ± 80.55
Allowable Dry Yield (kg/ha)	240.91 a ± 28.48	33.15 b ± 40.28
Stocking Rate(Head/ha/90day)	4.02 a ± 0.47	0.55 b ± 0.67

Means with different letters in the same row are significantly different

Plant List

A total of 24 plant species belongs to 14 plant family were found in the reserve. Due to protection that number of species was found. "Table 3" shows the Native Vegetation family name and scientific name of the reserve protected at Shoubak on May 2013. *Artemisia herba-alba* is the most dominant plant species.

At Shoubak, rangeland was deteriorated due to successive drought and man misuse. The present study was measured the effect of protection in rangeland productivity and making a comparison between the protected and non- protected areas. Results showed increasing of forage fresh yield, dry yield, allowable yield and plant species number. Those results are in agreement with those of Al-Satari *et al.* (2012) who showed at the northern part of Badia in Jordan that the average of fresh yield was increased from 457.80 kg/ha to 2739.10 kg/ha, dry yield from 213.47 kg/ha to 923.16 kg/ha,

allowable yield from 106.74 kg/ha to 461.58 kg/ha and stocking rate from 0.79 to 3.42 heads/ha/3 months for non-protected and protected areas, respectively. Those results are due to the large area that fenced and the long protection period at the South part in Khanasri which is a governmental station fenced for many years. Similar results were obtained by and MOA (2005) who showed increasing yield 5 folds due to protection.

Depending on this study protection increase plant growth and vegetation cover and forage yield. In addition, to soil erosion controlled, litter percent and root growth increased which improved soil proprieties and it's suitability for native vegetation growth.

Table 3: Native Vegetation Family and Scientific Name of the Protected Site at Shoubak

No.	Family	Scientific Name
1	Liliaceae	*Asphodelus sp.*
2	Caryophllaceae	*Silene sp.*
3		*Dianthus judicus*
4	Chenopodiaceae	*Salsola sp.*
5		*Noaea mucronata*
6	Compositae	*Anthemis spp.*
7		*Cardus getulus*
8		*Artemisia herba-alba*
9		*Achillea sp.*
10		*Varthemia iphionoides*
11	Cruciferae	*Erucaria bovena*
12	Cupressaceae	*Juniperus phonenice*
13	Fumariaceae	*Fumaria parviflora*
14	Geraniaceae	*Geranium sp.*
15	Graminae	*Poa sinica*
16		*Avena sp.*
17		*Aegilops sp.*
18	Iridaceae	*Iris sp.*
19	Labiatae	*Ballota sp.*
20		*Ziziphora sp.*
21	Leguminocae	*Astragalus sp.*
22	Nitrariaceae	*Peganum harmal*
23		*Nitraria retusa*
24	Dipsacaceae	*Scabiosa sp.*

RECOMMENDATIONS

Rangeland areas protection (prevent attacking and grazing) is highly recommended to increase their productivity, stocking rate, control rangeland deterioration and desertification. It is recommended to study the effect of fodder shrubs planting and fertilizer addition in the native vegetation cover and productivity.

ACKNOWLEDGEMENTS

We would like to thank Dr. Khaled Abulila, Dr. Maha Al-Syouf and Dr. Nasb Al-Rawashdeh for their help in plant taxonomy. We gratefully acknowledge Miss Maha Awad / Shoubak staff for her help in data entry.

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